MONITORING REPORT: 2ND VERIFICATION

Document Prepared by

Elen Enerji Üretimi Sanayi Ticaret A.Ş. (as Project Owner)
Life İklim ve Enerji Ltd. Şti. (as Carbon Consultant)

Project Title	Saracbendi HPP Run-of-River Hydro Project
Version	07
Report ID	-
Date of Issue	21-March-2023
Project ID	758
Monitoring Period	01-August-2013 to 31-July-2019 (both days are included)
Prepared By	Life İklim ve Enerji Ltd. Şti.
Contact	Address: Oğuzlar Mah. 1377. Sk. No:19/9 Balgat, Çankaya/Ankara E-mail: info@lifeenerji.com Website: https://lifeenerji.com/ Phone: 0090 312 481 21 42 Fax: 0090 312 480 88 10

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Saracbendi HPP is a 24.608 MWm/23.67 MWe[1] low head run-of-river power plant using a new weir structure to deviate river water of the Kızılırmak River into an intake structure with three settlement basins. From there it enters an open trapezoidal canal of 25.6 km length which runs along the left bank of the river. At the end a head pond is located with an intake to two steel penstocks of 3.90 m diameter and 159.9 m length each which lead to the powerhouse with the turbines. From there the water is released to the Kızılırmak River by an open canal. The powerhouse is an open type in a rock cut and houses 4 units Francis turbines with vertical shaft and 5.918 MWe each, i.e. 23.67 MWe installed capacity.

The purpose of the Project is to export the generated electricity to the regional grid, thereby contributing to the Turkey's electricity demand and rapidly growing economy. Since the Project generates electricity from renewable energy resources, it makes a significant contribution to climate protection. According to the validated VCS-PD, the Project was expected to generate ca. 100,470 MWh of electricity annually, and to reduce 55,170 tonnes of CO2 emissions per year, by supplying renewable energy that would have been supplied by the existing power grid that generates electricity predominantly from fossil fuel powered thermal power plants.

Detailed technical characteristics of Saracbendi HPP are given in Table 1 below.

Table 1 - Technical Characteristics of Saracbendi HPP[2]

Project Main Characteristics	Type:	Run-of-river HPP
	Total Installed Power:	23.67 MWe
	Power Generation:	100.47 GWh /year
Weir	Type:	Concrete, free overflow
	Construction dimensions:	8 m high; 84 m wide; 1.165 m elevation at crest
	Project (Max.) Discharge	50.00 m³/s
Turbine	Turbine Type	Vertical Francis
	Number of Units	4
	Unit Power	6.152 MW
	Installed Power	23.67
Generator	Number of Generators	4
	Power	5,918 MW
Transformers and transmission line	Number of Transformers	4
	Voltage	6.3/3.1.5±2x%2.5kV
	Frequency	50 Hz

[1] Please see: Provisional Acceptance Letter (page 7)

[2] Please see: Provisional Acceptance Letter in line with registered PD

	Transmision line	Connection to Şarkışla District Transformer Center 34.5 kV, 477 MCM section, 30 km transmission line.
Hydraulic Turbine	Type	HLA551C-LJ-170
Generator	Type	SF5918-22/3250
Turbine-1 and Generator-1	Product no of sets	ND2009022-01
Turbine-2 and Generator-2		ND2009022-02
Turbine-3 and Generator-3		ND2009022-03
Turbine-4 and Generator-4		ND2009022-04

First monitoring period covered the 27 months from 06-05-2011 to 31-07-2013 (both days were included). Total emission reductions achieved in the first monitoring period were 83,794 tons of CO2e. This monitoring period covers the 72 months from 01-08-2013 to 31-07-2019 (both days included). Total emission reductions achieved in this period are 176,224 tons of CO2e since electricity production is 320,939.95 MWh for this monitoring period.

1.2 Sectoral Scope and Project Type

The sectoral scope is 1: “Energy industries (renewable - / non-renewable sources)”. The installed capacity of the project is 23.67 MWe, thus it falls into a large-scale project activity.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Elen Enerji Üretimi Sanayi Ticaret A.Ş.
Contact person	Mustafa Kemal Güngör
Title	General Manager
Address	İlkbahar Mah. Turan Güneş Bulvarı Galip Erdem Cad. No:3
Telephone	+90 312 408 14 00
Email	info@akfenren.com.tr

1.4 Other Entities Involved in the Project

Organization name	Life İklim ve Enerji Ltd. Şti.
Role in the Project	Project Developer
Contact person	Kerem Aslan
Title	Carbon Consultant
Address	Oğuzlar Mahallesi, 1377. Sk. No:19, 06520 Çankaya/Ankara/ TURKEY
Telephone	+90 312 481 2142
Email	kerem.aslan@lifeenerji.com

1.5 Project Start Date

The project start date was 06-May-2011[3] which the project began generating GHG emission reductions or removals.

1.6 Project Crediting Period

Commissioning date of the project is 06 May 2011.

Start: 06-May-2011

End: 05-May-2021

10-years two-times renewed crediting period.

[3] Please see; Saraçbendi Provisional Acceptance Letter and Licence

1.7 Project Location

The project is located downstream of Yamula River on Kızılırmak River; it lies within the boundaries of Gemerek municipality, Sivas province, in Central Anatolian Region of Turkey. The closest settlements to the project site are Çepni village and Saraç village. The project area is 19 km northeast of Gemerek city (Sivas province), 22 km southwest of Şarkışla city (Sivas province) and 37 km north of Akkışla village (Kayseri province).

Table 2 - Geographical coordinates of the Weir and the Power plant[4]

	Weir	Power Plant
Latitude	39.3858	39.2547
Longitude	36.2571	36.0724

[4] Please see; Table 2 in approved PD

Figure 1: Location of the project

1.8 Title and Reference of Methodology

"Consolidated baseline methodology for grid connected electricity generation from renewable sources" (ACM0002 version 12.1.0)[5]

The above methodology is hereafter referred to as the "Baseline Methodology". The Baseline Methodology is used in conjunction with the approved monitoring methodology ACM0002 version 12.1.0 (subsequently referred to as "Monitoring Methodology").

The monitoring report also draws upon the:

- Tool for the demonstration and assessment of additionality, Version 5.2[6]
- Tool to calculate the emission factor for an electricity system, Version 2.2.0[7]

1.9 Participation under other GHG Programs

The project does not participate/has not participated in any other GHG program.

1.10 Other Forms of Credit

No GHG related environmental credits are applied to the Turkish power sector. No participation in any Emission Trading Programs and Other Binding Limits.

1.11 Sustainable Development

The project supports Turkey in stimulating and commercializing the use of grid connected renewable energy technologies and markets. The specific economic, social and technological benefits are:

- Reducing Turkeys expanding energy deficit;
- Diversification of Turkish electricity generation mix and reduction of import dependency;
- Creation of local employment and income during construction and operation of HPP (directly as well as indirectly via contracts with local providers for supply of construction material);
- Foster infrastructural investments with connected development benefits to the local rural community in the remote project area;

[5] https://cdm.unfccc.int/Panels/meth/meeting/10/046/mp46_an06.pdf

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf

Table 3 - Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.3	13.3.1 Air Quality	Electricity generation from Hydro Power Plant to abate the CO2 emissions.	176,224 tCO2e emission reduction during this MP.	260,018 tCO2e emission reduction over the project lifetime (06-May-2011 to 31-July-2019)
2)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Renewable electricity generation from Hydro Power Plant	320,939.95 MWh renewable electricity generation during this MP	473,543.30 MWh renewable electricity generation over the project lifetime (06-May-2011 to 31-July-2019)
3)	8.8	8.8.2 Quantitative employment and income generation	Increase in the number of employments with the help of Hydro Power Plant construction and operation	There are 13 employees have been working at the plant during this MP.	Throughout the construction and operation phases, employment has been provided by the Project Activity over the project lifetime.

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts have been observed/recorded for this monitoring period as confirmed by the project participant and stakeholders during the interviews. According to the relevant "Reporting form for Land Acquisition / Social Impacts of Portfolio Projects" for Saracbendi HPP, an Environmental Impact Assessment was not required.[8]

The project activity takes into account negative comments -mostly provide by mukhtar- from local stakeholders for socio-economic impacts of the project activity and implements an action plan to take necessary actions accordingly. Project activity takes precautions for possible environmental impacts of the project such as; wastewater storage and disposal of them, hazardous and domestic waste storage, fish passage, lifeline water and necessary trainings for all employees.

2.2 Local Stakeholder Consultation

Stakeholder engagement procedure was conducted at the Gemerek city and neighbourhood with the village head and the local stakeholders on 09-12-2021.
As validated during the site visit, although the general outcome of the discussions with the local people is positive verbally, the project owner is regularly following up with the local people whether they have any problems or requests. As a result of the follow-up, there was not any complaint received from the stakeholders during the site visit. There is not any significant update in the project implementation which may affect the project activity, implementation, stakeholders, and environment. There are also statements that 'there is no change' etc. in the meeting in terms of project design and implementation.
logbook is available for comments of local stakeholders. What's more, thanks to the Grievance Mechanism, local stakeholders have a chance to submit their requests and complaints to the project owner about the project. In addition, mukhtar (head of the village) had already taken the contact information (e.g mobile phone) of public relationships expert, project manager and assistant general director of the company so that the local stakeholders can be able to reach these people whenever they have any complaints, suggestions, or ideas about the project. They can be able to communicate with them in case of any problems.
Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar is made sure that there is continuous communication between the two parties.

Stakeholder meeting was performed on 09-December-2021 for this monitoring period.

2.3 AFOLU-Specific Safeguards

N/A

[8] Please see: Document of EIA is not required

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Saraçbendi HPP started to generate and provide electricity to the Turkish National Grid on 06-May-2011. During the monitoring period, there was no event or situation that occurred, which may impact the applicability of the methodology.

There were canal maintenance works in September 2014, August 2017 and September 2017. Due to maintenance works, electricity production by project activity shut down at the dates specified.

For the drop in the electricity generation of project activity in 2014, 2015 and 2017 years for this monitoring period, data, and studies on changes in the related river course may not be available. But the graphs of 'Rainfall and Rain Days' for Kayseri region and Sivas region are accessible via link[9] [10] below. We can easily observe the rainfall amount of 2014 year for comparison year. Therefore, it is observable that there are drastic decreases and increases in the velocity of the river course with the effect of rainfall apart from the other factors such as such as freezing in the river due to the climate condition of related area. Moreover, the values in the main data source are in the middle of the two different readings during the monthly readings which are provided in the ER excel spreadsheet. These values –where electricity production has decreased significantly due to climate change in this project activity - are conservative enough for the calculation of emission reduction.

[9] https://www.worldweatheronline.com/sivas-weather-averages/sivas/tr.aspx

[10] https://www.worldweatheronline.com/kayseri-weather-averages/kayseri/tr.aspx

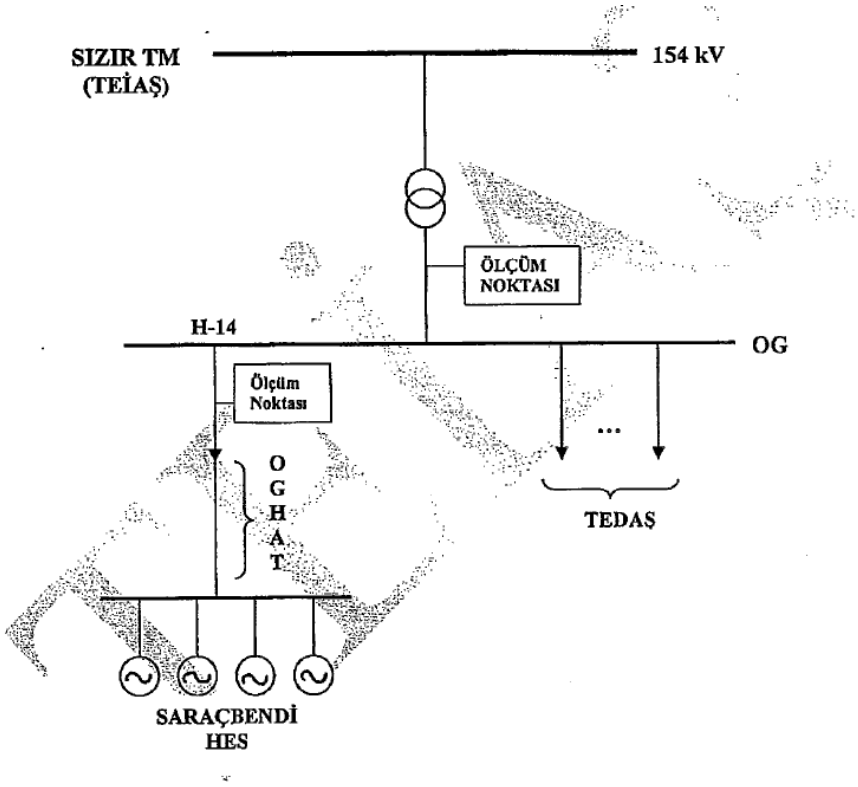

Figure 2: Single Line Diagram[11]

Date (DD-MM-YYYY)	Project Activity
08-04-2005 21-02-2008 (revised)	Issuance of the License
25-08-2007	Requests for Proposals from Consultants for VER Development
17-04-2008	Start of first Construction Activities
28-05-2008	Contract with Hangzhou Yatai Hydro Equipment Comp. Co. Ltd. (generators/turbines)
01-09-2008	Initial Agreement with a VER Consultant
25-05-2009	Financial Closure with Bank
01-09-2009	Contract with EPM Elektrik Proje Montaj İnşaat Ltd. Şti. (Electrical equipment)
13-04-2010	Signature with FutureCamp Türkiye for VER Development
06-05-2011	Start of operation
06-05-2011	Start of the 1st monitoring period
31-07-2013	End of the 1st monitoring period
01-08-2013	Start of the 2nd monitoring period
31-07-2019	End of the 2nd monitoring period

[11] Provisional Acceptance Letter (Page 121)

3.2 Deviations

3.2.1 Methodology Deviations

N/A

3.2.2 Project Description Deviations

- Çamlıca Elektrik Üretim A.Ş. has transferred the project to Elen Enerji Üretimi Sanayi ve Ticaret A.Ş. with all its rights as per generation licence[12].
- The meter reading procedure physically can be delayable due to weather conditions or any temporary causes. Thus, to provide a continuity of the existance of cross-check values, following up the invoices of electricity generations and consumptions of the project are also added to the cross-check method under the $EG_{facility,y}$ monitoring parameter.
- The data from the Electricity Meters are the basis for the settlement notification of EPIAS and web screenshots of EPIAS are used and will be used as main source of data for monitoring. TEİAŞ is responsible for meter readings and these data are used and will be used for cross-checking in line with the 2nd project description deviation above.

  The project description deviations above do not impact the applicability of methodology, baseline and additionality. All three are small deviations for project activity.

3.3 Grouped Projects

N/A

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO2/MWh
Description	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”

[12] Please see: Generation Licence

Source of data	As per "Tool to calculate the emission factor for an electricity system"
Value applied	0.5491 tCO2/MWh
Justification of choice of data or description of measurement methods and procedures applied	As per "Tool to calculate the emission factor for an electricity system"
Purpose of Data	For calculation emission factor
Comments	No additional comments

Data / Parameter	**Gross electricity generation**
Data unit	MWh
Description	Gross Electricity supplied to the grid by relevant sources (2006-2008)
Source of data	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1975-2008) TEİAŞ. Please see: https://webapi.teias.gov.tr/file/d68d12d1-7b09-4c5a-bd1d-bd29b40b97e5?download
Value applied	131,681,100 MWh; 154,982,500 MWh; 163,919,400 MWh
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	Net Electricity Generation
Data unit	MWh
Description	Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)

Source of data	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Electricity Generation Consumption and Losses in Turkey (1984-2008) TEİAŞ. Please see: https://webapi.teias.gov.tr/file/ae3e13fb-9d07-4128-a1d9-d5ce9ed1458c?download
Value applied	169,543.1 GWh; 183,339.7 GWh; 189,761.9 GWh
Justification of choice of data or description of measurement methods and procedures applied	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants. Import and Export data is used to identify total net electricity fed into the grid in the years of 2006, 2007 and 2008. TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	Sample Group for BM emission factor
Data unit	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description	Most recent power plants which compromise 20% of total generation
Source of data	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEİAŞ: For plants in 2004: https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download For plants in 2005: https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download For plants in 2006: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download For plants in 2007: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download

	For plants in 2008: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download
Value applied	See Validated VCS-PD
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PD preparation was for 2008.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	$EF_{CO2,I,y}$
Data unit	tCO2/GJ
Description	Emission factor for fuel type i
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. Please see: https://www.ipcc-nggip.iges.or.jp/public/2006gl/
Value applied	See Validated V*CS-PD*.
Justification of choice of data or description of measurement methods and procedures applied	The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations that is dedicated to providing the world with objective, scientific information relevant to understanding the scientific basis of the risk of human-induced climate change, its natural, political, and economic impacts and risks, and possible response options.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	$\eta_{m,y}$
Data unit	-
Description	Average energy conversion efficiency of power unit m in year y

Source of data	Annex I the "Tool to calculate the emission factor for an electricity system"
Value applied	See Validated V*CS-PD*.
Justification of choice of data or description of measurement methods and procedures applied	For efficiency rates of Coal and Lignite Power Plants See Annex-1 of the Tool (highest rate is applied to be conservative) For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	**$HV_{i,y}$**
Data unit	Mass or volume unit
Description	Heating Values of fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data	Heating Values of Fuels Consumed in Thermal Power Plants in Turkey by The Electric Utilities, TEİAŞ. Please see: https://webapi.teias.gov.tr/file/346a8564-97c6-4027-b674-6ac3def3ba29?download
Value applied	See validated VCS-PD
Justification of choice of data or description of measurement methods and procedures applied	There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type. TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	**$FC_{i,y}$**
Data unit	Mass or volume unit
Description	Fuels consumed for electricity generation in the years of 2006, 2007 and 2008

Source of data	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by The Electric Utilities, TEİAŞ. Please see: (2000-2005) https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download (2006-2008) https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download
Value applied	See Validated VCS-PD.
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

Data / Parameter	**$NCV_{i,y}$**
Data unit	TJ/kton, TJ/million m^3
Description	Net Calorific Value of fuel types in the years of 2006, 2007 and 2008
Source of data	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.
Value applied	See Validated VCS-PD.
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey.
Purpose of Data	Combined Margin Calculations
Comments	No additional comments

4.2 Data and Parameters Monitored

Data / Parameter	**$EG_{facility,y}$**
Data unit	MWh/yr

Description	Quantity of net electricity generation supplied to the grid in year y
Source of data	The data from the Electricity Meters are the basis for the settlement notification of EPIAS. Data are gathered electronically from the meters by TEIAS and stored in secured website of EPIAS, which is accessible to project developer with a private password. For monitoring, web screenshots of EPIAS are used as source of data.
Description of measurement methods and procedures to be applied	Two electricity meters are placed (one main and one reserve) at the substation. One is the main meter (Actaris SL761B071 model with serial number 53064431) and the other one is the backup meter (Actaris SL761B071 with serial number 53064432).

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency
Main Meter	53064431	ACTARIS – SL761B071	0.5s	50 Hz
Back-up meter	53064432	ACTARIS – SL761B071	0.5s	50 Hz

Latest test protocol date is 21-02-2018 for both of the meters during this monitoring period. As a result, there are another test protocol reports which dates are given below.

- 30-04-2011 (initial meter test)
- 06-04-2014
- 16-08-2015
- 02-10-2016
- 21-02-2018
- 08-09-2019 and
- 28-07-2020,

The meters have the accuracy of 0.5s. These meters are sealed by distribution company and intervention by project proponent is not possible.

The meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid is calculated by electricity supplied minus electricity withdrawn which are taken from monthly settlement notifications. Two meters are back-up each other. These meters are chosen according to national regulations and approved and sealed

	by TEIAS at start-up of the plant. Maintenance and calibration of the metering devices are making by TEIAS periodically.[13] In addition to invoices and metering devices, the electricity delivered to the grid can be cross-checked through meter-reading protocols providing by TEIAS. All records are keeping for at least two years as requested by the applied methodology. All meters kept the data for four months in case of any breakdown. If any meter is found to be out of calibration, accurate energy amounts shall be detected via substitute counter group since registry values of the main counter group is the same as of the substitute group in the last measurement.
Frequency of monitoring/recording	The primary and back-up measurement devices measure, read and record various data such as electricity generated and consumed, in real-time. The measurements and recordings are made continuously. The readings are performed in monthly intervals. There is no sampling involved.
Value monitored	320,939.95 MWh
Monitoring equipment	***Calibration frequency:*** According to the Article 9 of the relevant regulation[14], periodical inspections of "gauges for electric, water, coal gas, natural gas and, current and voltage measuring transformers will be made once in 10 years". This is in line with the monitoring plan and national requirements. TEIAS is deciding when to carry out the next calibration. The Project owner has no control over or access to the measurement devices and is not entitled to perform any type of maintenance or calibration. ***Date of last calibration:***

Vintage		Electricity supplied to the grid (MWh)	Electricity consumption from the grid (MWh)	Net electricity supplied to the grid (MWh)
01/08/2013	31/12/2013	6,592.69	47.76	6,544.93
01/01/2014	31/12/2014	29,601.01	131.72	29,469.29
01/01/2015	31/12/2015	70,861.43	60.85	70,800.58
01/01/2016	31/12/2016	68,352.43	42.53	68,309.90
01/01/2017	31/12/2017	41,421.19	77.11	41,344.08
01/01/2018	31/12/2018	45,309.22	46.39	45,262.83
01/01/2019	31/07/2019	59,216.44	8.10	59,208.34
Total		321,354.41	414.46	320,939.95

[13] Please see, Index Protocols

[14] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5

	Calibration tests are performed by ITRON FRANCE. In addition to the first calibration TEİAŞ was performed tests on both main and backup meters. Frequency of the tests is determined by TEİAŞ, and the test mentioned above is the first test performed on the meters. Also in the test report prepared by the TEİAŞ it is stated that meters are in line with the IEC/TSE 62053-22 standard. ***Responsible personnel:*** TEIAS is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. TEIAS is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the back-up meter etc.), the plant manager in the name of the Project owner is responsible for coordinating the necessary maintenance and calibration procedure with TEİAŞ.
QA/QC procedures to be applied	Maintenance and calibration of the metering devices will be made by TEIAS periodically. If there is a significant difference between the readings of two devices, maintenance and tests of the metering devices and the associated equipment will be done before waiting for the periodical maintenance.
Purpose of the data	Calculation of baseline emissions
Calculation method	The net electricity amount supplied to the grid is calculated by electricity supplied minus electricity withdrawn.
Comments	The electricity meters specified in the 'Description of measurement methods and procedures to be applied' section was changed on 28-07-2020, but since this date is not within the monitoring period range, information about the change protocol is not included in this MR.

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Equipment specifications that described in the equipment contracts
Description of measurement methods and procedures to be applied	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.

Frequency of monitoring/recording	Yearly
Value monitored	23,672,000
Monitoring equipment	Official documents and photos of the generator and turbine
QA/QC procedures to be applied	Producing company is responsible for the information in the instrument specifications.
Purpose of the data	To follow up the change in the capacity of the project
Calculation method	Equipment specifications and provisional acceptance
Comments	Cross-checked value of the installed power is same as previous monitoring period and approved PD.

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full
Source of data	Technical drawings from consultants
Description of measurement methods and procedures to be applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Yearly
Value monitored	992,982.5263
Monitoring equipment	Maps
QA/QC procedures to be applied	Area of the reservoir are preparing according to necessary calculations and Ministry of Energy and Natural Resources of Turkey is the responsible ministry for the confirmation of topographical survey and calculations.
Purpose of the data	To follow up the change in the reservoir area/s
Calculation method	N/A
Comments	No additional comments

4.3 Monitoring Plan

As described above, the relevant data that has to be monitored is the electricity supplied to the grid (EG_y) per year, the installed capacity of the hydro power plant and the area of the reservoir.

EG_y:
These data are subject to the accounting quality systems of both parties to the power purchase agreement, TEİAŞ and Elen Enerji Üretimi Sanayi Ticaret A.Ş. With this, no additional structures or processes have to be implemented to insure the availability of necessary data for monitoring.

At the end of one monitoring period, which is planned to generally last one year, the data from the monthly meter reading records by PMUM (In approved PD, PMUM records were given as reference for electricity generation. However, the name of this institution was changed, and electricity generation records have been belonged to EPİAŞ) Therefore, EPİAŞ records added up to the yearly electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation.

In addition to the EPİAŞ records, TEİAŞ is responsible for reading monthly on both main and backup meters. Meter reading protocols for whole of the monitoring period have been provided as cross check values.

Responsible personnel:

TEIAS is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. TEIAS is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the back-up meter etc.), the plant manager in the name of the Project owner is responsible for coordinating the necessary maintenance and calibration procedure with TEİAŞ. Thus, the complete baseline approach is always transparent and traceable.

Technicians in Saracbendi HPP daily reads meters and keeps record for electricity generation amount and reports to management. These records can be used for monitoring in case of any problem will arise in meters.

Cap_{PJ} and A_{PJ}
These data will be stated for monitoring yearly. Power density of the project is greater than 10 W/m2 so there is no GHG emission due to project activity which is explained under section 4.3.

Currently 13 people are working in the plant. Currently the following information on staff and responsibilities at Saracbendi HPP can be seen below:

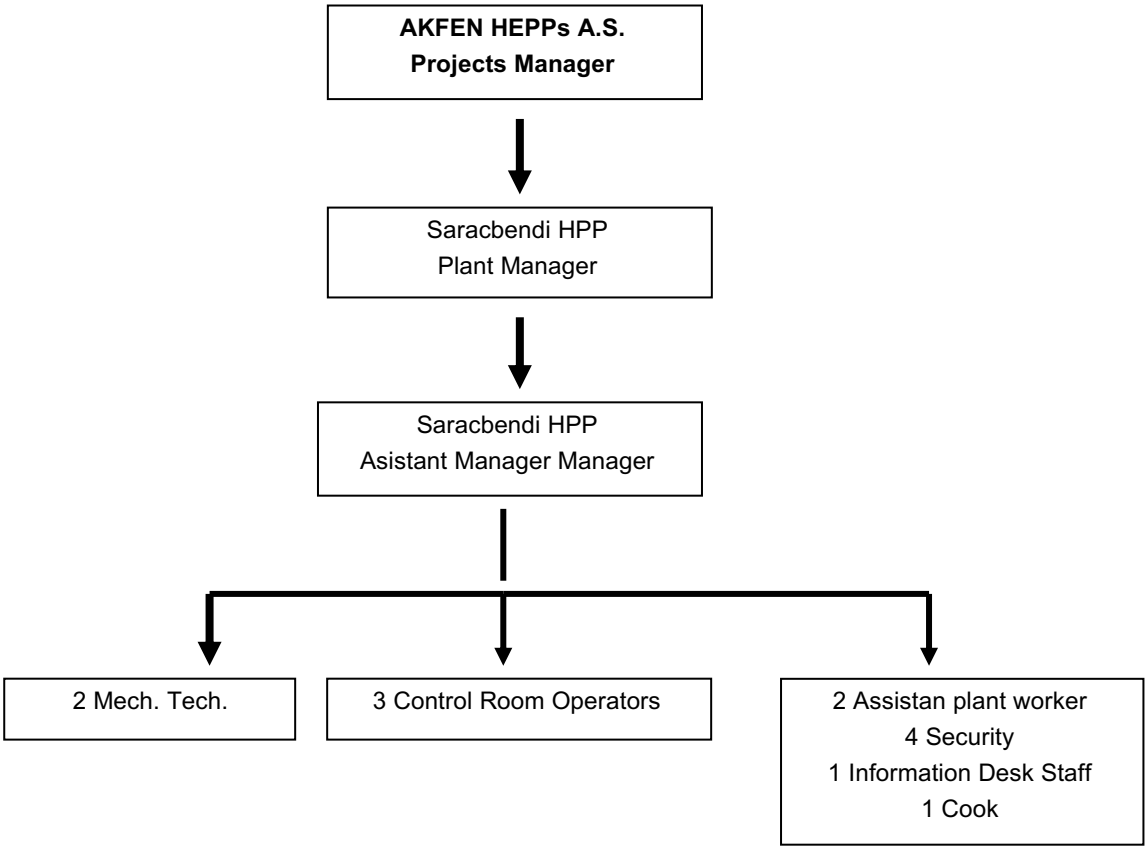

Figure 3: Organization chart

All data monitored under the monitoring plan are keeping in electronic form and hard copy for 2 years after the end of the crediting period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per ACM0002 baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. This is calculated as per formula 6:

$$BE_y = (EG_{PJ,y}) \times EF_{grid,CM,y} \quad \textbf{(6)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the .Tool to calculate the emission factor for an electricity system. (tCO_2/MWh)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The project activity is the installation of a new grid-connected renewable power plant, thus $EG_{PJ,y} = EG_{facility,y}$ (ACM0002 page 9, equation 7).

It follows that:

$BE_y = EG_{facility} * EF_{grid,CM,} = 320,939.95 \text{ MWh} * 0.5491 \text{ tCO2/MWh}$
$= \mathbf{176,224\ tCO_2}$ (Round-downed)

The comparison of actual and estimated emission reduction calculations as follows:

Vintage		actual ER (tCO2e)	estimated ER (tCO2e)	% by year
01-08-2013	31-12-2013	3,593	23,126	-84%
01-01-2014	31-12-2014	16,181	55,170	-71%
01-01-2015	31-12-2015	38,876	55,170	-30%
01-01-2016	31-12-2016	37,508	55,321	-32%
01-01-2017	31-12-2017	22,702	55,170	-59%
01-01-2018	31-12-2018	24,853	55,170	-55%
01-01-2019	31-07-2019	32,511	32,044	1%
Total		**176,224**	331,171	-47%

5.2 Project Emissions

Project emissions are calculated as follows:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$

Where:

PE_y = Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ = project emissions from fossil fuel consumption in year y (tCO_2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

$PE_{FF,y}$ is zero as there will be no fossil fuel consumption to generate electricity and $PE_{GP,y}$ is zero as the project is not a geothermal project activity.

In order to calculate project emissions from water reservoir of the plant, power density should be calculated. The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \textbf{(5)}$$

PD= Power density of the project activity

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For the new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity when reservoir is full (m2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

As the project acitivity is not extension of another project, Cap_{BL} and A_{BL} are zero, then

$$PD = \frac{Cap_{PJ}}{A_{PJ}}$$

As in the case of Saracbendi HPP this density is well above the 10 W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23.672 MW), emissions (CH_4 and CO_2) from the reservoir are zero (ACM0002, page 8). According to the tool (page 7), for the projects having power density more than 10 W/m2 threshold is zero. Hence, the project emission (PE_y) is zero.

5.3 Leakage

As described in the ACM0002 methodology version 12.1.0 , no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

5.4 Net GHG Emission Reductions and Removals

BEy = (EGPJ,y) x EFgrid,CM,y

Where:

BEy = Baseline emissions in year y (tCO2/yr).

EGPJ,y = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

EFgrid,CM,y = Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the .Tool to calculate the emission factor for an electricity system. (tCO2/MWh)

EGfacility,y = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The project activity is the installation of a new grid-connected renewable power plant, thus EGPJ,y = EGfacility,y (ACM0002).

Emission reductions due to project activity have to be calculated as per formula 11 of ACM0002:

$ER_y = BE_y - PE_y - L_y$ **(11)**

Where:

ER_y = Emission reductions in year y (tCO_2/yr).

BE_y = Baseline emissions in year y (tCO_2/yr).

PE_y = Project emissions in year y (tCO_2/yr).

Ly = Leakage

Then:

$ER_y = BE_y$

- Total emission reductions achieved in this period are 176,224 tons of CO2e.
- Total clean electricity generation achieved in this period are 320,939.95 MWh.
- There are 13 employees in the project during this monitoring period.

Saracbendi HPP is a run-of-river HPP, the electricity amount supplied to the grid depends on external physical conditions, i.e. the flow rate. That is why, actual emission reduction amounts are 47% lower than estimated amount since electricity generated is also lower than the estimated amount of electricity. As a result, the actual emission reductions are less than the estimated emission reduction amount.

It follows that:

$BE_y = EG_{facility,y} * EF_{grid,CM,}$ = 320,939.95 MWh/year * 0.54912 tCO2/MWh = **176,224 tCO_2/year**

With an actual annual project electricity generation of amounts which was given in the Appendix 1 of this report, and $EF_{grid,CM,y}$ calculated in Registered PD as 0.5491 tCO2/MWh[15], net GHG emission reductions/removals are:

[15] Registered PD

Months	Baseline emissions or baseline net GHG removals by sinks (tCO2e)	Project emissions or actual net GHG removals by sinks (tCO2e)	Leakage (tCO2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO2e)
Aug-13	138	0	0	138
Sep-13	515	0	0	515
Oct-13	663	0	0	663
Nov-13	958	0	0	958
Dec-13	1,320	0	0	1,320
Sum 2013	3,593	0	0	3,593
Jan-14	1,417	0	0	1,417
Feb-14	1,405	0	0	1,405
Mar-14	2,411	0	0	2,411
Apr-14	2,180	0	0	2,180
May-14	1,352	0	0	1,352
Jun-14	1,206	0	0	1,206
Jul-14	287	0	0	287
Aug-14	188	0	0	188
Sep-14	-7	0	0	-7
Oct-14	705	0	0	705
Nov-14	1,571	0	0	1,571
Dec-14	3,467	0	0	3,467
Sum 2014	16,181	0	0	16,181
Jan-15	3,442	0	0	3,442
Feb-15	4,364	0	0	4,364
Mar-15	7,315	0	0	7,315
Apr-15	7,994	0	0	7,994
May-15	6,862	0	0	6,862
Jun-15	3,719	0	0	3,719
Jul-15	1,379	0	0	1,379
Aug-15	336	0	0	336
Sep-15	105	0	0	105
Oct-15	1,119	0	0	1,119
Nov-15	897	0	0	897
Dec-15	1,343	0	0	1,343
Sum 2015	38,876	0	0	38,876
Jan-16	1,954	0	0	1,954
Feb-16	3,705	0	0	3,705
Mar-16	6,420	0	0	6,420
Apr-16	5,850	0	0	5,850
May-16	6,900	0	0	6,900
Jun-16	5,440	0	0	5,440
Jul-16	2,302	0	0	2,302
Aug-16	855	0	0	855
Sep-16	698	0	0	698
Oct-16	1,256	0	0	1,256
Nov-16	1,145	0	0	1,145
Dec-16	984	0	0	984
Sum 2016	37,508	0	0	37,508
Jan-17	1,280	0	0	1,280

Feb-17	1,248	0	0	1,248
Mar-17	4,381	0	0	4,381
Apr-17	6,379	0	0	6,379
May-17	4,803	0	0	4,803
Jun-17	2,250	0	0	2,250
Jul-17	337	0	0	337
Aug-17	-6	0	0	-6
Sep-17	-7	0	0	-7
Oct-17	375	0	0	375
Nov-17	361	0	0	361
Dec-17	1,300	0	0	1,300
Sum 2017	22,702	0	0	22,702
Jan-18	1,470	0	0	1,470
Feb-18	2,397	0	0	2,397
Mar-18	6,831	0	0	6,831
Apr-18	3,742	0	0	3,742
May-18	3,181	0	0	3,181
Jun-18	2,657	0	0	2,657
Jul-18	519	0	0	519
Aug-18	205	0	0	205
Sep-18	269	0	0	269
Oct-18	582	0	0	582
Nov-18	879	0	0	879
Dec-18	2,122	0	0	2,122
Sum 2018	24,853	0	0	24,853
Jan-19	3,901	0	0	3,901
Feb-19	4,682	0	0	4,682
Mar-19	6,409	0	0	6,409
Apr-19	7,270	0	0	7,270
May-19	6,607	0	0	6,607
Jun-19	2,777	0	0	2,777
Jul-19	865	0	0	865
Sum 2019	32,511	0	0	32,511
Total Sum	***176,224***	***0***	***0***	***176,224***

APPENDIX 1: <NET ELECTRICITY GENERATION>

Months	Electricity supplied to the grid (MWh) (1)	Electricity consumption from the grid (MWh) (2)	Net electricity supplied to the grid[MWh] (3) =(1)-(2)
Aug-13	265.84	14.14	251.70
Sep-13	947.02	9.84	937.18
Oct-13	1,216.34	9.17	1,207.17
Nov-13	1,748.34	4.07	1,744.27
Dec-13	2,415.15	10.54	2,404.61
Sum 2013	6,592.69	47.76	6,544.93
Jan-14	2,596.78	16.51	2,580.27
Feb-14	2,571.44	12.36	2,559.08
Mar-14	4,401.41	11.47	4,389.94
Apr-14	3,979.15	8.42	3,970.73
May-14	2,471.76	9.39	2,462.37
Jun-14	2,204.66	8.58	2,196.08
Jul-14	535.39	12.06	523.33
Aug-14	358.00	15.22	342.78
Sep-14	0.00	13.63	-13.63
Oct-14	1,293.90	10.89	1,283.01
Nov-14	2,872.25	11.43	2,860.82
Dec-14	6,316.27	1.76	6,314.51
Sum 2014	29,601.01	131.72	29,469.29
Jan-15	6,270.49	1.29	6,269.20
Feb-15	7,946.74	0.01	7,946.73
Mar-15	13,322.90	0.67	13,322.23
Apr-15	14,558.94	0.00	14,558.94
May-15	12,496.97	0.00	12,496.97
Jun-15	6,774.33	0.73	6,773.60
Jul-15	2,516.39	4.32	2,512.07
Aug-15	622.93	11.05	611.88
Sep-15	208.17	16.46	191.71
Oct-15	2,047.53	10.10	2,037.43
Nov-15	1,642.07	8.77	1,633.30
Dec-15	2,453.97	7.45	2,446.52
Sum 2015	70,861.43	60.85	70,800.58
Jan-16	3,564.97	6.11	3,558.86
Feb-16	6,749.90	2.92	6,746.98
Mar-16	11,692.43	0.63	11,691.80
Apr-16	10,654.24	1.08	10,653.16
May-16	12,566.68	0.01	12,566.67
Jun-16	9,906.70	0.33	9,906.37
Jul-16	4,193.92	1.18	4,192.74

Aug-16	1,562.24	4.98	1,557.26
Sep-16	1,277.12	6.13	1,270.99
Oct-16	2,291.34	4.18	2,287.16
Nov-16	2,089.01	3.62	2,085.39
Dec-16	1,803.88	11.36	1,792.52
Sum 2016	68,352.43	42.53	68,309.90
Jan-17	2,332.28	1.22	2,331.06
Feb-17	2,275.71	2.61	2,273.10
Mar-17	7,981.14	1.92	7,979.22
Apr-17	11,616.90	0.12	11,616.78
May-17	8,747.81	0.17	8,747.64
Jun-17	4,098.95	0.59	4,098.36
Jul-17	621.53	8.26	613.27
Aug-17	0.00	10.24	-10.24
Sep-17	0.00	13.17	-13.17
Oct-17	695.82	13.16	682.66
Nov-17	675.32	17.77	657.55
Dec-17	2,375.73	7.88	2,367.85
Sum 2017	41,421.19	77.11	41,344.08
Jan-18	2,678.16	1.17	2,676.99
Feb-18	4,364.73	0.29	4,364.44
Mar-18	12,439.95	0.02	12,439.93
Apr-18	6,815.91	1.19	6,814.72
May-18	5,794.33	0.69	5,793.64
Jun-18	4,839.07	0.40	4,838.67
Jul-18	952.19	7.29	944.90
Aug-18	383.01	9.84	373.17
Sep-18	500.29	9.81	490.48
Oct-18	1,067.90	7.79	1,060.11
Nov-18	1,608.27	6.81	1,601.46
Dec-18	3,865.41	1.09	3,864.32
Sum 2018	45,309.22	46.39	45,262.83
Jan-19	7,103.96	0.11	7,103.85
Feb-19	8,526.65	0.02	8,526.63
Mar-19	11,670.97	0.01	11,670.96
Apr-19	13,240.71	0.01	13,240.70
May-19	12,032.95	0.01	12,032.94
Jun-19	5,057.79	0.13	5,057.66
Jul-19	1,583.41	7.81	1,575.60
Sum 2019	59,216.44	8.10	59,208.34
Total Sum	***321,354.41***	***414.46***	***320,939.95***